

## WE CLAIM:

1. A method of reprogramming a cell, said method comprising:
  - (a) incubating a nucleus from a donor cell with an extract under conditions that allow the removal of a factor from said nucleus or the addition of a factor from said extract to said nucleus; and
  - (b) inserting said nucleus or a chromatin mass formed from said nucleus into a recipient cell or cytoplasm, thereby forming a reprogrammed cell.
- 10 2. A method of reprogramming a cell, said method comprising:
  - (a) incubating a nucleus from a donor cell with an extract under conditions that allow the removal of a factor from said nucleus or the addition of a factor from said extract to said nucleus; and
  - (b) inserting said nucleus or a chromatin mass formed from said nucleus into a recipient cell or cytoplasm of a different somatic cell type, thereby forming a reprogrammed cell.
- 15 3. A method of reprogramming a cell, said method comprising:
  - (a) incubating a chromatin mass from a donor cell with an extract under conditions that allow the removal of a factor from said chromatin mass or the addition of a factor from said extract to said chromatin mass; and
  - (b) inserting said chromatin mass or a nucleus formed from said chromatin mass into a recipient cell or cytoplasm, thereby forming a reprogrammed cell.
- 25 4. A method of reprogramming a cell, said method comprising:
  - (a) incubating a chromatin mass from a donor cell with an extract under conditions that allow the removal of a factor from said chromatin mass or the addition of a factor from said extract to said chromatin mass; and
  - (b) inserting said chromatin mass or a nucleus formed from said chromatin mass into a recipient cell or cytoplasm of a different somatic cell type, thereby forming a reprogrammed cell.

5. A method of reprogramming a cell, said method comprising incubating a permeabilized cell with an extract under conditions that allow the removal of a factor from the nucleus or a chromosome of said permeabilized cell or the addition of a factor from said extract to said nucleus or said chromosome, thereby forming a  
5 reprogrammed cell.

6. A method of treating or preventing a disease, disorder, or condition in a mammal, said method comprising:

10 (a) incubating a nucleus from a donor cell with an extract under conditions that allow the removal of a factor from said nucleus or the addition of a factor from said extract to said nucleus;

(b) inserting said nucleus or a chromatin mass formed from said nucleus into a recipient cell or cytoplasm, thereby forming a reprogrammed cell; and

15 (c) administering said reprogrammed cell to a mammal in need of said reprogrammed cell.

7. A method of treating or preventing a disease, disorder, or condition in a mammal, said method comprising:

20 (a) incubating a nucleus from a donor cell with an extract under conditions that allow the removal of a factor from said nucleus or the addition of a factor from said extract to said nucleus;

(b) inserting said nucleus or a chromatin mass formed from said nucleus into a recipient cell or cytoplasm of a different somatic cell type, thereby forming a reprogrammed cell; and

25 (c) administering said reprogrammed cell to a mammal in need of said cell type.

8. A method of treating or preventing a disease, disorder, or condition in a mammal, said method comprising:

30 (a) incubating a chromatin mass from a donor cell with an extract under conditions that allow the removal of a factor from said chromatin mass or the addition of a factor from said extract to said chromatin mass;

(b) inserting said chromatin mass or a nucleus formed from said chromatin mass into a recipient cell or cytoplasm, thereby forming a reprogrammed cell; and

5 (c) administering said reprogrammed cell to a mammal in need of said reprogrammed cell.

9. A method of treating or preventing a disease, disorder, or condition in a mammal, said method comprising:

10 (a) incubating a chromatin mass from a donor cell with an extract under conditions that allow the removal of a factor from said chromatin mass or the addition of a factor from said extract to said chromatin mass;

(b) inserting said chromatin mass or a nucleus formed from said chromatin mass into a recipient cell or cytoplasm of a different somatic cell type, thereby forming a reprogrammed cell; and

15 (c) administering said reprogrammed cell to a mammal in need of said cell type.

10. A method of treating or preventing a disease, disorder, or condition in a mammal, said method comprising:

20 (a) incubating a permeabilized, cell with an extract under conditions that allow the removal of a factor from the nucleus or a chromosome of said permeabilized cell or the addition of a factor from said extract to said nucleus or said chromosome, thereby forming a reprogrammed cell; and

25 (b) administering said reprogrammed cell to a mammal in need of said cell type.

11. The method of any one of claim 1-10, wherein said extract is an interphase extract or a mitotic extract.

30 12. The method of claim 1, 2, 5, 6, 7 or 10 wherein said nucleus remains membrane-bounded and the chromosomes in said nucleus do not condense during incubation with said extract.

13. The method of claim 1, 2, 5, 6, 7 or 10 wherein a chromatin mass is formed from incubation of said nucleus or said permeabilized cell in said extract.

14. The method of claim 1, 2, 6 or 7, wherein said chromatin mass is  
5 incubated in an interphase extract under conditions that allow a nucleus to be formed from said chromatin mass and said reformed nucleus is inserted into said recipient cell or said recipient cytoplasm.

15. The method of claim 5 or 10, wherein said reprogrammed cell is  
10 incubated under conditions that allow the membrane of said reprogrammed cell to reseal.

16. The method of any one of claims 1-10, wherein at least 5 mRNA or protein molecules are expressed in said reprogrammed cell that are not expressed in  
15 said donor cell or said permeabilized cell.

17. The method of any one of claims 1-10, wherein at least 5 mRNA or protein molecules are expressed in said donor cell or said permeabilized cell that are not expressed in said reprogrammed cell.

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18. The method of any one claims 1-10, wherein said donor cell or said permeabilized cell is an interphase or mitotic cell

19. The method of any one of claims 1-10, wherein said donor cell, said  
25 permeabilized cell, said recipient cell, said recipient cytoplasm, or said reprogrammed cell is an epithelial cell, neural cell, epidermal cell, keratinocyte, hematopoietic cell, insulin-producing cell, melanocyte, chondrocyte, B-cell, T-cell, erythrocyte, macrophage, monocyte, fibroblast, muscle cell, embryonic stem cell, or adult stem cell.

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20. The method of claim 19, wherein said donor cell or said permeabilized cell is a B-cell or fibroblast and said reprogrammed cell is a T-cell.

21. The method of any one of claims 1-10, wherein said recipient cell or said cytoplasm is an undifferentiated cell.

22. The method of any one of claims 1-10, wherein said donor cell, said  
5 permeabilized cell, said recipient cell, or said recipient cytoplasm is from a human.

23. The method of any one of claim 6-10, wherein said disease, disorder, or condition is a neurological, immune, autoimmune, endocrine, cancer, inflammatory, or muscular disease, disorder, or condition.

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24. Use of a reprogrammed cell for the treatment or prevention of a disease, disorder, or condition in a mammal comprising:

(a) incubating a nucleus from a donor cell with an extract under conditions that allow the removal of a factor from said nucleus or the addition of a  
15 factor from said extract to said nucleus;

(b) inserting said nucleus or a chromatin mass formed from said nucleus into a recipient cell or cytoplasm, thereby forming a reprogrammed cell; and

(c) administering said reprogrammed cell to a mammal in need of said reprogrammed cell.

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25. Use of a reprogrammed cell for the treatment or prevention of a disease, disorder, or condition in a mammal comprising:

(a) incubating a nucleus from a donor cell with an extract under conditions that allow the removal of a factor from said nucleus or the addition of a  
25 factor from said extract to said nucleus;

(b) inserting said nucleus or a chromatin mass formed from said nucleus into a recipient cell or cytoplasm of a different somatic cell type, thereby forming a reprogrammed cell; and

(c) administering said reprogrammed cell to a mammal in need of said  
30 cell type.

26. Use of a reprogrammed cell for the treatment or prevention of a disease, disorder, or condition in a mammal comprising:

(a) incubating a chromatin mass from a donor cell with an extract under conditions that allow the removal of a factor from said chromatin mass or the addition of a factor from said extract to said chromatin mass;

5 (b) inserting said chromatin mass or a nucleus formed from said chromatin mass into a recipient cell or cytoplasm, thereby forming a reprogrammed cell; and

(c) administering said reprogrammed cell to a mammal in need of said reprogrammed cell.

10 27. Use of a reprogrammed cell for the treatment or prevention of a disease, disorder, or condition in a mammal comprising:

(a) incubating a chromatin mass from a donor cell with an extract under conditions that allow the removal of a factor from said chromatin mass or the addition of a factor from said extract to said chromatin mass;

15 (b) inserting said chromatin mass or a nucleus formed from said chromatin mass into a recipient cell or cytoplasm of a different somatic cell type, thereby forming a reprogrammed cell; and

(c) administering said reprogrammed cell to a mammal in need of said cell type.

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28. Use of a reprogrammed cell for the treatment or prevention of a disease, disorder, or condition in a mammal comprising:

25 (a) incubating a permeabilized, cell with an extract under conditions that allow the removal of a factor from the nucleus or a chromosome of said permeabilized cell or the addition of a factor from said extract to said nucleus or said chromosome, thereby forming a reprogrammed cell; and

(b) administering said reprogrammed cell to a mammal in need of said cell type.

30 29. The use of any one of claim 24-28, wherein said extract is an interphase extract or a mitotic extract.

30. The use of any of claims 24, 26 or 28 wherein said nucleus remains membrane-bounded and the chromosomes in said nucleus do not condense during incubation with said extract.

5           31. use of any of claims 24, 26 or 28, wherein a chromatin mass is formed from incubation of said nucleus or said permeabilized cell in said extract.

10          32. The use of any of claims 24 or 25, wherein said chromatin mass is incubated in an interphase extract under conditions that allow a nucleus to be formed from said chromatin mass and said reformed nucleus is inserted into said recipient cell or said recipient cytoplasm.

15          33. The use of claim 28, wherein said reprogrammed cell is incubated under conditions that allow the membrane of said reprogrammed cell to reseal.

20          34. The use of any of claims 24- 28, wherein at least 5 mRNA or protein molecules are expressed in said reprogrammed cell that are not expressed in said donor cell or said permeabilized cell.

25          35. The use of any of claims 24- 28, wherein at least 5 mRNA or protein molecules are expressed in said donor cell or said permeabilized cell that are not expressed in said reprogrammed cell.

30          36. The use of any of claims 24- 28, wherein said donor cell or said permeabilized cell is an interphase or mitotic cell

35          37. The use of any of claims 24- 28, wherein said donor cell, said permeabilized cell, said recipient cell, said recipient cytoplasm, or said reprogrammed cell is an epithelial cell, neural cell, epidermal cell, keratinocyte, hematopoietic cell, insulin-producing cell, melanocyte, chondrocyte, B-cell, T-cell, erythrocyte, macrophage, monocyte, fibroblast, muscle cell, embryonic stem cell, or adult stem cell.

38. The use of claim 37, wherein said donor cell or said permeabilized cell is a B-cell or fibroblast and said reprogrammed cell is a T-cell.

39. The use of any of claims 24- 28, wherein said recipient cell or said  
5 cytoplasm is an undifferentiated cell.

40. The use of any of claims 24- 28, wherein said donor cell, said  
permeabilized cell, said recipient cell, or said recipient cytoplasm is from a human.

10 41. The use of any of claims 24- 28, wherein said disease, disorder, or  
condition is a neurological, immune, autoimmune, endocrine, cancer, inflammatory,  
or muscular disease, disorder, or condition.